Small Business Innovation Research (SBIR) and State Funding Opportunities and Proposal Preparation Workshop

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WORKSHOP DOCUMENT (FINAL)

Where's the Money?

The Small Business Innovation Research Program (SBIR) is the only vehicle by which the Environmental Protection Agency (EPA) can give funds to businesses for research and development (R&D). EPA is a mission agency with regulatory responsibilities; therefore, the agency is not otherwise allowed to give R&D contracts directly to businesses.

The EPA SBIR program supports the development of innovative environmental technologies in areas of interest to EPA. In 2011, the SBIR solicitation will include a focus on the need for improved drinking water treatment technologies, including sustainable innovations that address contaminants, decrease energy demands and reduce the cost of treatment, and provide solutions to water infrastructure problems.

The U.S. EPA, along with CincyTech, the U.S. Small Business Administration, and the tri-state Water Technology Innovation Cluster, organized this workshop to provide companies with information about writing proposals for U.S. SBIR and other innovative technology research and development funding opportunities. This workshop is part of a recent initiative to collaborate with both regional and national stakeholders to provide research and support for advancing improved environmental technologies and practices from proof-of-concept to development and implementation.

This workshop document will provide a number of important tips that can help you develop a winning SBIR proposal.

Small Business Access to Federal Research and Development Funds

The SBIR was enacted in 1982 as part of the Small Business Innovation Development Act.

The purpose of the program is to stimulate technological innovation, utilize small businesses to meet federal R&D needs and increase private sector commercialization. The program provides early-stage R&D funding directly to small technology companies or individual entrepreneurs who form a company. Small businesses must meet the following criteria to participate: (1) be American-owned and independently operated; (2) be for-profit; (3) employ no more than 500 employees; and (4) employ the principal researcher. Joint ventures and limited partnerships are eligible for SBIR awards, provided the entity created qualifies as a small business. Each year, the following 11 federal departments and agencies are required to reserve a portion of their R&D funds for awards through the program:

- **Department of Agriculture (USDA)**
- **Department of Commerce (DOC)**
- **Department of Defense (DOD)**
- **Department of Education (ED)**
- **Department of Energy (DOE)**
- **Department of Health and Human Services (HHS)**
- **Department of Homeland Security (DHS)**
- **Department of Transportation (DOT)**
- **Environmental Protection Agency (EPA)**
- **National Aeronautics and Space Administration (NASA)**
- **National Science Foundation (NSF)**

SBIR is a highly competitive three phase award program. Phase I is a feasibility study to evaluate the scientific and technical merit of an idea. Phase II is to expand on the results of and to further pursue the development of Phase I. Phase III is the commercialization of Phase II results and requires the use of private sector or non-SBIR federal agency funding.

The Small Business Technology Transfer (STTR) Program was established by Congress in 1992. Six federal agencies with R&D budgets over $1 billion conduct STTR programs: DHS, DOD, DOE, HHS, NASA and NSF. The program is similar in structure to SBIR but funds cooperative R&D projects involving a small business and a research institution (i.e., university, federally funded R&D center or nonprofit research institution).

The purpose of the program is to stimulate technological innovation, utilize small businesses to meet federal research and development (R&D) needs and increase private sector commercialization.

Innovative Solutions for Environmental Problems EPA's Small Business Innovation Research (SBIR) Program

EPA's SBIR Program

EPA is one of 11 federal agencies that participate in the SBIR Program. EPA programs view SBIR technologies as a means for providing lower capital and operational cost options and controlling pollution in more efficient and effective ways. Every year, EPA issues solicitations for Phase I and Phase II research proposals from science and technology- based firms. EPA awards nearly $5 million in funding annually. The solicitation is posted on the National Center for Environmental Research web site at www.epa.gov/ncer/sbir.

EPA programs view SBIR technologies as a means of helping them meet their goals of preventing, reducing, or monitoring pollution.

Phase I of the program is designed to investigate the scientific and technical feasibility of technologies. EPA awards up to $80,000 and also provides free commercialization assistance during Phase 1. The period of performance is typically six months. Less than 10% of the applicants are funded.

Only Phase I winners are eligible for Phase II. The objective of Phase II is to commercialize and develop the Phase I technology. Competitive awards are based on the results of Phase I and the commercialization potential of the Phase II technology. In Phase II, EPA awards contracts of up to $300,000 and the period of performance is typically 2 years. EPA also offers a supplement of up to $ 70,000 and one additional year as a Phase II Option for firms with third-party financing for accelerating commercialization. Approximately 40% of Phase II applicants are funded.

How to win an SBIR award

Winning an EPA SBIR award requires preparatory work such as reading the solicitation, reviewing topic descriptions, searching the EPA web site for previous awards and clearly understanding the environmental problem. The next steps is to build a team with which to brainstorm, plan and select an approach. Developing a quality proposal involves preparing an outline and a realistic work plan, emphasizing your strengths, showing the potential of your idea, providing a cost breakdown and describing a clear path to commercialization. This step includes clearly outlining the agency priority needs your technology addresses and the potential environmental benefits it should provide. A good proposal will contain key figures and tables, a third-party independent evaluation, letters of support and an excellent executive summary. Key figures and tables, specifically the pert chart and work plan, are essential because they help the reviewer to skim the proposal. They are always in the outstanding proposals. An excellent executive summary is particularly important because typically only three members of the External Peer Review Panel read the entire proposal. The other members receive the executive summary and a report with recommendations from the panel. The three members present the report to the rest of the panel and then answer questions. The panel then ranks the proposals. Only those proposals with the highest ratings of "excellent" or "very good" are passed on to the internal EPA Programmatic Review Panel, which makes the final funding recommendations. 2011 EPA SBIR Phase I Solicitations will open around March 15, 2011 in the following topics:

Developing a quality proposal involves devising an outline and a realistic work plan, emphasizing your strengths, showing the potential of your idea and describing a clear path to commercialization.

- Drinking Water
- Wastewater, Stormwater and Water Reuse
- Innovation in Manufacturing
- Green Building
- Waste Monitoring
- Greenhouse Gases and other Climate Forcers
- Air Pollution Monitoring and Control
- Sustainable Utilization of Biomass
- Homeland Security

A good proposal will contain key figures and tables, a third-party independent evaluation, letters of support and an excellent executive summary.

Other Options

Other agencies, such as DOD, DOE and NIH, and NSF have environmental topics in their SBIR solicitations. These agencies have much larger budgets and often will have two solicitations per year. Some agencies are willing to discuss the topics with companies prior to the solicitation and may be open to suggestions for future topics. For the NSF program, most environmental technologies are covered under the NSF Biotechnology and Chemical Technology (BC) and Environmental Technologies (ET) topic or the Nanotechnology, Advanced Materials and Manufacturing (NM) topic. NSF Phase I solicitations will begin in spring of 2011.

For more information:
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web site: www.epa.gov/ncer/sbir

Maximizing SBIR Success by Utilizing Other State and Federal Programs

Understanding the Phase Structure of the SBIR Program

Phase I is a proof of concept phase that establishes the feasibility of the project. You have to win here to be eligible to compete for Phase II. Up to $150,000 is available in Phase I, depending on the agency, to demonstrate the innovativeness of your technology, its importance, and its commercial potential. Phase II, worth up to $1 million, again depending on the agency, is to develop the concept to the prototype stage. To successfully win this phase, a solid R&D plan needs to be clearly articulated, the market identified, and your knowledge, commitment and ability to commercialize demonstrated. Phase III is the ultimate goal-commercialization.

Agency Differences

It is extremely important to know the differences between agencies. First, the dollar amount for each phase is different. Second, the mission of each agency is different and therefore so are each agency's research objectives. Third, the type of review process is different: peer review vs. line review.

Peer review- in peer review there are external reviewers, usually looking for the development of great technologies. Agencies that utilize peer review are: USDA, HHS, ED, NSF, and EPA.

Line review- this is used by agencies looking for a product to meet their needs at the end of the process. Agencies that use line review are: DOC, DOD, DOE, DOT, and NASA.

Optimize your chances of winning by scanning all agencies for research topics where your technology/research effort could apply. Your technology may be of interest to more than EPA.

What are the Program Advantages and Benefits of the SBIR/STTR Program?

The SBIR/STTR program provides more than $2.5 billion in R&D funding annually for small businesses. It provides funding for *high risk* ideas and solicits a wide range of topics. It enables the development of a technology base. The program leaves patent and proprietary rights with small businesses. It requires no repayment of the money received and requires no equity sacrifice.

However, the SBIR/STTR programs are highly competitive, requiring excellence in all aspects of the competition process. A commitment to win the competition is essential, even if the first attempt is unsuccessful. If the first proposal is unsuccessful, the agency will provide comments. With those comments incorporated, the chances of winning a resubmission are increased.

Problems Typically Encountered

Some common reasons for proposal rejection are: 1) lack of a technically sound concept and/or logical approach to the project; 2) a failure to demonstrate knowledge of the technical field (what is the current state-of-the-art), the market potential, and the impact of the idea on society

(the big picture); 3) submission of a budget that is not in accordance with government accounting regulations; 4) the absence of a description of how the management team will commercialize the product, particularly in Phase II; and 5) likely the most common reason for rejection is a failure to follow directions for preparing and submitting the proposal.

SBIR proposals are unique, requiring different proposal writing skills. Applicants must be able to write technically so nontechnical people understand (line review) or to write technically so technical people not strong in the applicants' discipline understand (peer reviews).

The good news is that support is available through Small Business Development Centers (SBDC), SCORE, Association of Procurement Technical Assistance Center (APTAC), state economic development districts, university industrial cooperation offices, state financial support programs for early seed capital/loan investments and industry and trade organizations.

Summary of presentation by David Patch, a regional SBIR expert, in 2003 at an EPA SBIR proposal preparation workshop.

Proposal Preparation for SBIR

Before You Write - Thinking About Applications

Before writing a proposal, think about who might need your technology. Ideally you want to have both a government user and a commercial user in mind. The way these people will use the technology is called an application for the technology.

Applications are built around the needs of users. They are context bound. The engineering specifications and other characteristics of your technology must meet these needs as well as comply with any relevant regulations and/or standards and certification requirements (i.e., UL for electric consumer products). The following are sources of information on standards, certification and regulations:

- American National Standards Institute NSSN global standards search engine: **www.nssn.org**
- Federal Regulations: **www.gpoaccess.gov/cfr**
- Forthcoming Federal Regulations: **www.regulations.gov**
- State Laws and Regulations: **www.llsdc.org/state-leg**

Applications are also time bound. The year of commercial introduction is not necessarily the current year. The requirements and traits that embody end-user needs may change over time so you may have to design your project to "hit" a moving target.

With the applications in mind, find a topic in an agency solicitation under which you can submit a proposal. In choosing an agency and topic in which to compete, remember that programs and topics with growing funding are better targets than those that are shrinking—more money equals more opportunity. New programs or topics are better targets than established programs—no established competitors to knock out. Topics addressing high priority problems are better targets than programs that do not—they need a solution so they are willing to try innovative solutions. Topics which do not describe a design for the technological solution are better targets if you are developing a product but worse if you are developing a process—you have to know what you will build before you worry about building it more efficiently.

Writing the Proposal

Now you are ready to write. There are three themes behind successful SBIR/STTR proposals. These three themes can be mapped into the proposal.

Proposal Significance

What is the significance of the problem? What problems are you going to solve and for whom? What are you going to produce? What difference will your effort make to them?

Proposal Technical Objectives

How are you going to go about resolving the problem identified above? What are your specific technical objectives and how do you intend to demonstrate their feasibility? What are the details of the work plan for accomplishing the objectives?

Proposal Outline

Background/Work Plan: What are the scientific/technical quality, the innovativeness and the originality of the proposed project? This issue is seldom addressed in a distinct part of the proposal. Rather, you should keep your attention on this issue throughout the proposal.

Staff, Facilities and Equipment: Why are you the right firm to perform the work? What evidence can you provide to establish your firm's credibility including your awareness of the state-of-the-art, your firm's previous experience in conducting related research and development and the qualifications of key personnel, consultants and your facilities?

Some Hints!

Create check lists. This applies to proposals and to performance. At the beginning of the program, make check lists. During the work effort, check items off the lists. Before delivery, check all lists, and then deliver a complete and correct product. Here are some things to include in your check lists: Does the content violate laws of physics, economics or common sense? Is the math correct? Are your cost tables correct? Have you edited the proposal for spelling, grammar, clarity, etc.? Are there any blank page errors, incomplete and/or inconsistently labeled charts and is the pagination correct? What did independent reviewers say about your proposal (after all, you are too close to it to be objective)?

Make the proposal look good! When you are writing, ask yourself, "Who am I writing for?" and "Can I listen to this proposal if it is read aloud?" Think about graphics. Ask, "How can this information best be grasped - through graphics?" Also ask, "Will graphics cut down the length of my proposal?" Remember your reviewer will have a stack of proposals on the desk.

Get a debriefing. Always debrief if you lose so you can do better next time. Decide in advance whether you are likely to appeal. Request debriefings in writing and highlight in your request any specific information you want to know. Request a debriefing by technical personnel. Before the debriefing, request copies of all reviews and be familiar with them. Make debriefings a key part of your marketing strategy.

Summary of presentation by Phyl Speser, J.D., Ph.D., a nationally known SBIR proposal preparation expert and an SBIR multiple award winner.

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Proposing SBIR: From Thought to Bought

There are **three keys to writing a good proposal** which are patterned after Weinberg's Element of Technical Innovation (Weinberg, 1986). **The first key is understanding the problem.** This will require you to read the specifications, review the state-of-the-art, consult with the independent experts, talk to the topic sponsors and contact the end-user. Look for high priority topics. **The second key is managing the flow of ideas.** This involves building a team and enlisting the experts without necessarily becoming one. **The third key is maintaining quality.** The proposal is your first "product." It is important to secure resources necessary to do the work, monitor progress, manage customer expectation and deliver a quality product.

Ingredients of a Winner

You must clearly understand the customer's requirements. Broaden your capability. Only a true genius works in isolation; for the rest of us, collaboration is key. Show the potential of your ideas and a clear path to commercialization. It is okay to go out on a limb and over commit yourself. Most of all —DON'T QUIT; learn from losing.

The Elements of a Phase I Program

Your technology must be a new approach. You must demonstrate the capability and the resources of the team. Show clear cost and performance benefits if the project is successful. Identify main risk areas. Phase I is a time to show proof of principle and to reduce risks. Make sure your scope of work is realistic. Request a maximum dollar amount to go farther faster. Get an independent evaluation. Make sure your project ties to a major agency program. A key to getting Phase II funding is to deliver a "touchy-feely" at the end of Phase I.

Writing the Phase I Proposal

Read the instructions. Visualize the proposal flow. Determine the content of the illustrations. Do an outline or story board and then write the sections out of order. As a general guideline, the Intro/summary should be about one page; Phase I technical objectives, one page; Phase I work plan, three to four pages; Commercialization plan, one page; and Identification and significance of the problem or opportunity, four to five pages. Eliminate repetition. Format attractively. Leave time for critical review. Remember that **a good proposal skims easily but withstands thorough critical review.** In light of this, make sure to include the following key figures and tables: a concept diagram; a performance comparison; a program schedule; and, milestones. Letters of support also go a long way.

Summary of presentation by Jack DeMember, Ph.D., Business Development Manager of Foster-Miller, Inc., in 2003 at an EPA SBIR proposal preparation workshop.

Federal Agency SBIR/STTR Program Contact Information

Each participating federal agency administers its SBIR/STTR program differently. Each has its own priorities and areas of focus. The following lists provide general and participating agency contact information. The National SBIR Conference Center is a particularly good source of consolidated resource information. The web sites of the participating agencies provide additional information on the agency's SBIR/STTR program from which you can download current solicitations.

Department of Agriculture (USDA)
(www.csrees.usda.gov/funding/sbir/sbir.html)

Department of Commerce (DOC) (www.rdc.noaa.gov/~amd/sbir.html)
- **National Oceanic and Atmospheric Administration (NOAA)** (www.oar.noaa.gov/orta)
- **National Institute of Standards and Technology (NIST)** (www.nist.gov/sbir)

Department of Defense (DOD) (www.acq.osd.mil/sadbu/sbir)
- **Air Force SBIR/STTR Virtual Mall** (www.wpafb.af.mil/library/factsheets/factsheet.asp?id=5560)
- **Army** (www.arl.army.mil/www/default.cfm?page=10)
- **Chemical and Biological Defense Program (CBD)** (www.jpeocbd.osd.mil)
- **Defense Advanced Research Projects Agency (DARPA)** (www.darpa.mil/Opportunities/SBIR_STTR/SBIR_STTR.aspx)
- **Defense Logistics Agency (DLA)** (www.dla.mil/db)
- **Defense Microelectronics Activity (DMEA)** (www.dmea.osd.mil/smallbiz.html)
- **Defense Technical Information Center (DTIC)** (www.dtic.mil/dtic/aboutus/dodprograms/sbir.html)
- **Defense Threat Reduction Agency (DTRA)** (www.dtra.mil/Business/CurrentSolicitations.aspx)
- **Missile Defense Agency (MDA)** (www.mda.mil/business/smallbus_programs.html)
- **National Geospatial-Intelligence Agency (NGA)** (https://www1.nga.mil/about/WorkingWithUs/ResearchGrants/SBIR/Pages/default.aspx)
- **Navy** (www.onr.navy.mil)
- **Special Operations Acquisition and Logistics Center (SOCOM)** (www.socom.mil/sordac/OtherOffices/Pages/SmallBusinessInnovativeResearchProgram.aspx)

Department of Education (ED) (www.ed.gov/offi ces/OERI)

Department of Energy (DOE) (sbir.er.doe.gov/sbir)

Department of Health and Human Services (HHS) (www.hhs.gov/grants)
- **National Institute of Health (NIH)** (grants1.nih.gov/grants/oer.htm)
- **Center for Disease Control (CDC)** (www.cdc.gov/od/science/PHResearch/sbir.htm)
- **Food and Drug Administration (FDA)** (www.fda.gov/AboutFDA/business/ucm119348.htm)

Department of Homeland Security (DHS) (https://www.sbir.dhs.gov/index.aspx)

Department of Transportation (DOT) (www.volpe.dot.gov/sbir)

Environmental Protection Agency (EPA) (www.epa.gov/ncerqa/sbir)

National Aeronautics and Space Administration (NASA) (sbir.nasa.gov)

National Science Foundation (NSF) (www.eng.nsf.gov/sbir)

How to Write a Competitive Proposal

As you prepare to write your SBIR proposal, there are some things you should keep in mind about the proposal review, grading and selection process. Proposal reviewers are a heterogenous group of people. They have personalities, other jobs and interests, objective capabilities, subjective feelings, moods, etc. Evaluators have varying reading habits:

- **Conscientious reader 30%**
- **Skimmer 30%**
- **Peruser/Reader's Digest 30%**
- **Critic 10%**

Therefore, it is important to make their job as easy as you can. Work on the quality appearance of your proposal. Write a proposal that holds interest and is easy to read. Do not make the reviewer dig for information; highlight key issues and use pictures, tables and figures.

Abstract

The abstract should identify the problem and your solution to the problem, and describe why the solution will work, plans to demonstrate the solution and the benefits to be derived. Here is an example of an abstract:

Plastic media blast (PMB) is rapidly growing as a coating removal method because it does not damage composite or soft metal surfaces when compared with the effects of chemical stripping solvents or hard abrasives (i.e., sand). However, the conventional PMB materials are all highly resistant to biodegradation. A commercially available, biodegradable plastic known as PHBV® and manufactured by Imperial Chemical Industries, is proposed as a biodegradable plastic media blast (BPMB). This new class of biodegradable polymers has several unique features which make it an ideal candidate as a BPMP: (1) microorganisms rapidly biodegrade it to CO_2 and water, (2) it is not affected by water or humidity like starch-blast media, (3) like conventional thermoplastics, it can be melted, molded, or extruded, and (4) different hardness characteristics can be engineered into the polymer formulations. Lynntech, Inc. has outlined a comprehensive Phase I project for conversion of raw PHBV® into 20-30 mesh abrasive, testing and evaluation of coating removal characteristics using established procedures for PMB application, documenting biodegradation features, and performing a cost analysis. This will form the basis for transitioning this new material to commercial production and application.

Write a proposal that holds interest and is easy to read. Convince the reviewer that you are the best qualified to carry out the project.

Describe who/what will benefit from the success of your work. Develop either a general or specific pathway to commercial use.

WHAT: Identification and Significance of the Problem

Revisit the problem and introduce the basis for innovation (solution). Explain how solutions logically merge with the problem. Introduce an overview of the Technical Objectives. Discriminator: Boldface one or two thoughts you really want to impress upon the reviewer. **Do all this on the first page**.

WHY: Background

Develop the framework for merging the innovation with the problem to provide the solution. Explain the problem and the innovation in detail. Develop the premise of why your innovation will work. Discriminator: Explain how you have positioned yourself using preliminary work or data to start "ahead" of this project.

HOW Part I: Technical Approach

Walk the reviewer through the project in general terms. A drawing or diagram of the project components is extremely helpful. What is stated in the work plan (tasks) will track with specific objectives.

HOW Part II: Technical Objectives - Tasks

Identify tasks or steps needed to demonstrate the innovation and how it applies to the solution. When giving task description, give the reviewer a guided tour of exactly (step by step) what you plan to do to accomplish each task. Do not leave any room for assumptions. Use recognized procedures or standard methods where possible; this establishes credibility. Be sure the work outlined answers the questions but is not impossible to accomplish.

WHEN: Schedule

The objective of the schedule is to demonstrate that thought and planning have been directed toward the project. Be sure that the schedule is directly related to tasks. Strive for quick startup. Show a logical progression of events vs time. Be reasonable; build in time for Murphy's Law. Discriminator: This is the key place where you set in the reviewers mind that: (1) You have a logical, realistic plan and (2) You can pull it off.

The abstract should identify the problem and your solution to the problem, and describe why the solution will work, plans to demonstrate the solution and the benefits to be derived.

Commercial Potential

Describe who/what will benefit from the success of your work. Develop either a general or specific pathway to commercial use. Provide cost analysis data that have solid data for the conventional technology(s) and provide an estimate of how the new process costs-out. Introduce future plans by including an outline of where you go after this project and a plan for how you will interface with your industry partner.

Key Personnel

Provide qualification and related work experience for the principal investigator (P.I.). Convince the reviewer that you are the best qualified to carry out the project. Involve one or more expert consultants in your project. Identify and obtain support from an industrial partner.

Equipment/Instrumentation and Facilities

Briefly describe all equipment and instrumentation that is available to support this project. If analytical work or other tests are performed outside, tell who and where. Describe facilities where project will be carried out. Show how you fit in the management structure if necessary.

The proposed budget for accomplishing your research plan must be realistic. All direct cost items must be justified.

Proposal Budget

The proposed budget for accomplishing your research plan must be realistic. Include one month of P.I. time on Phase I, two months on Phase II. Also include adequate man-hours for engineering and technical personnel. You must establish an engineering overhead rate and G&A rate. All direct cost items must be justified. Travel must be directly related to carrying out the project. You must demonstrate the ability to capture direct and indirect costs as they occur (time sheets and purchase orders). An accounting system appropriate for government contracts must be in place before a Phase II award can be made. Keep in mind that pre-award and post-awards audits are likely to be made.

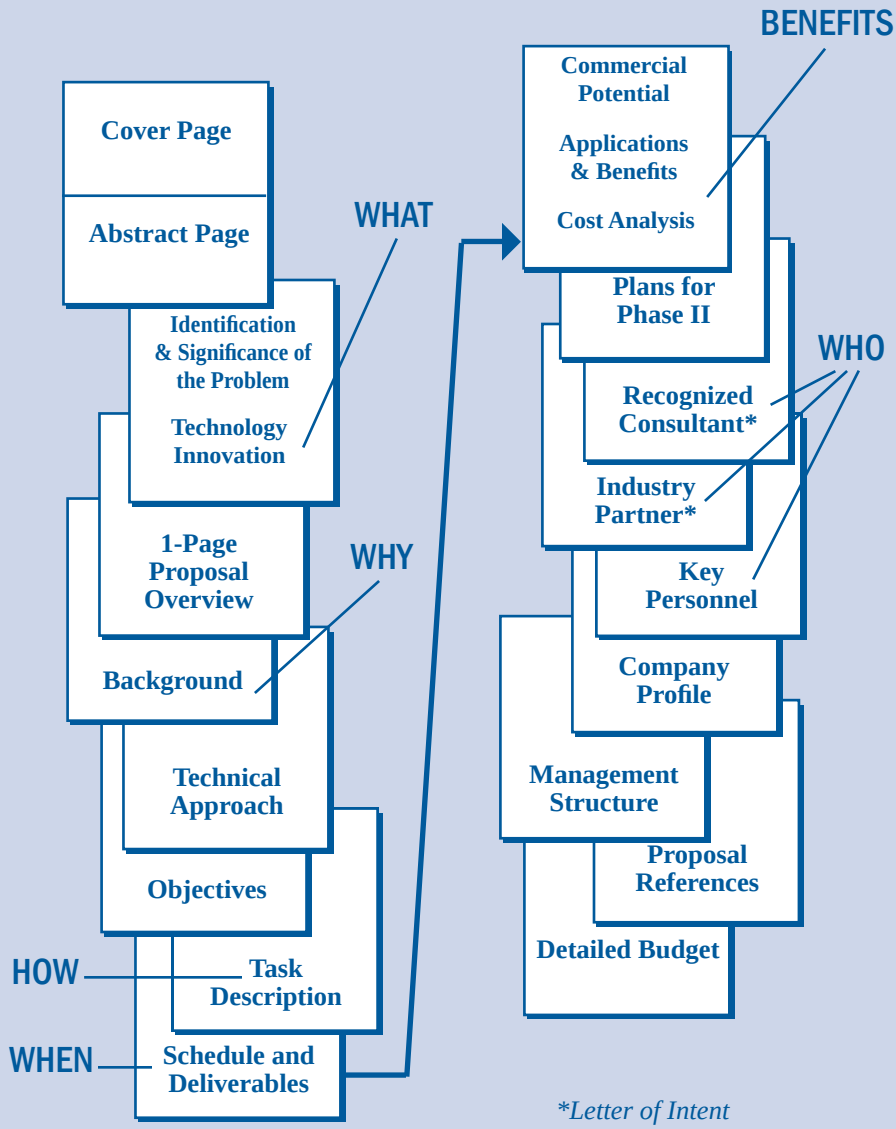
Proposal Preparation Schedule

Most successful proposals are written with a timetable or schedule. Provide sufficient time to think the project through and adequately research the background. Develop and rework the research approach. Define technical objectives and develop work plans that adequately satisfy technical objectives. Prepare a complete draft of the proposal and leave it for a few days. Then review the proposal and make changes that will give rise to significant improvements. You are now ready to prepare the final draft and submit the proposal.

Successful proposals demonstrate a realistic and achievable schedule. Define work plans to satisfy technical objectives.

From handout created by Oliver J. Murphy, President of Lynntech, Inc. Lynntech, Inc. is a multiple SBIR award winner.

Key Elements of an SBIR Proposal



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Commercializing Technology

Goals/Capabilities

The first step to commercialization is thinking about your goals and capabilities. Why do you want to commercialize? Is it to make money? Do you have other goals of success, such as prestige or publications? These goals can be translated into clear objectives for future negotiations. In setting objectives, it helps to distinguish among must-have items, like-to-have items and no-way items. The first set enables you to meet your goals. If someone offers them to you, take them. Everything else is nice to have and sweetens the deal. Of course, avoid the no-way items. Now review these goals to bring them into coherence with your firm's business strategy, positioning and capabilities. Remember that you must have something to sell. You must be able to complete R&D, design the product, complete production engineering, produce the product, support it and distribute it. If you do not have all the capabilities and resources needed to get the product or service to market on your own, partnering for these capabilities and resources is probably going to be a key part of your goal for commercialization.

The first step to commercialization is thinking about your goals and capabilities. Why do you want to commercialize?

Your Technology

The second step in commercializing is to figure out who will buy your technology. To do so, you must find where the performance and characteristics of your technology intersects with the needs of end-users. You must make it cheaper or easier for the users to do their job or make it possible for them to sell something new or more of what they already sell. In short, if the users cannot have a better life or make money from your technology, why buy it? You can find out about needs through web searches, traditional library literature searches, contacting associations and requesting road-maps or other authoritative statements of their members needs or by interviewing experts. Also important is to understand the standards, certifications and government regulations the users will expect your technology to meet or comply with.

You must make it cheaper or easier for the users to do their job or make it possible for them to sell something new or more of what they already sell.

Market Conditions

The third step is to investigate market conditions. What technology will you compete against? What firms? How do firms who sell to end-users compete in the industry? How do firms who will be vying with you to sell technology to the firms that manufacture and distribute products for and to the end-user compete? To find out about technology, look at: (1) patents (**www.uspto.gov**), (2) federal research and development projects, (3) scholarly literature, (4) news groups, (5) list servers, (6) conferences/symposia and (7) preprint repositories. To evaluate the size, structure and dynamics of the market, contact: experts; associations; leading firms competing in the market; and, web services like Electric Library and Dialog. Find a market where you think you can successfully compete.

You must be able to complete R&D, design the product, complete production engineering, produce the product, support it and distribute it.

Doing Deals

Now you need a partner to help you commercialize the technology. Usually this will be a major corporation, but it also can be another small company, a venture capitalist or angel, or even a state agency funding high tech economic development or environmental projects. When you talk with your targets, in order to better plan and move to a deal, ask the following kinds of questions: Who are the decision makers? How long is the decision process? Who will be involved and in what roles or functions? What criteria will be important and why? What specific information will be desired? Are their models or examples of deals that the target has made in the past?

What technology will you compete against? What firms? How do firms who sell to end-users compete in the industry?

Summary of presentation by Phyl Speser, J.D., Ph.D., a nationally known SBIR proposal preparation expert and an SBIR multiple award winner.

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SBIR Program Success Stories

The following are the success stories of two companies that received EPA SBIR funding. The technologies, briefly described in this section, hold great promise for future environmental benefits. These companies demonstrated the technical feasibility and commercialization potential of technologies that could benefit the public and further the Agency's mission. These companies are: **WWETCO, LLC,** Roswell, Georgia **and Rheonix, Inc.,** Ithaca, New York.

WWETCO, LLC

Environmental Problem

To satisfy water quality criteria or total maximum daily load (TMDL) allocations, regulated sources of wet weather pollution [stormwater, combined sewer overflows (CSOs), and sanitary sewer overflows] require cost-effective flow control and treatment technologies. Flow controls maximize wet weather flows that can be treated without inhibiting drainage system hydraulics or blocking the flow path. Conventional flow control includes fixed weirs or more expensive mechanical devices that can inhibit the drainage system hydraulics or create higher capital and maintenance costs. Conventional approaches, in which devices are placed in the flow path, risk upstream flooding or less than optimal wet weather treatment.

SBIR Technology Solution

With support from EPA's SBIR Program, WWETCO, LLC has developed a non-mechanical, passive-flow control device that will maximize flow attenuation and diversion of wet weather volumes to treatment. The WWETCO flow control can be installed at a cost comparable to the most inexpensive fixed weir controls. The device is simple, compact, and able to handle high velocities carrying trash and abrasive materials with virtually no maintenance. It is not affected by corrosive environments. The passive flow control device consists of a flexible bladder that opens at the bottom in a structure containing a static fluid that seals the bladder against a conduit that transports dry and/or wet weather flow. The technology can be used in a stream or water conveyance channel, piping network, storage basin or structure, and as a part of a treatment system. The WWETCO flow technology can be incorporated into the outlet of stormwater ponds to carry a fixed water level during dry weather or to completely drain yet maximize their effectiveness for each runoff event.

The flow control device uses differential hydraulic pressure across the membrane to passively maintain an upstream water level during changing flow conditions. The flexible membrane takes on a shape to create the head loss required to maintain the upstream water level and pass the excess flow to the downstream level. The design allows the passage of aquatic biology or other base flows during dry weather. During runoff conditions after the upstream storage has been fully utilized, the flexible membrane lifts upward as needed to pass any excess volume or debris.

Commercialization Information

Commercial applications include the optimization of various flow controls, such as diversion, storage, migratory tolerant stream attenuation, inline storage, flow to treatment, creating head for treatment, pond/stream level management, irrigation, fish ladders, or other situations requiring the maintenance of an upstream level. The preliminary commercialization plan was developed from Phase I research results and combined with local, state, and federal agency surveys of wet weather control needs. The Phase II commercialization plan defined full-scale hydraulic and operation performance, fabrication and production, specific marketing strategies, information dissemination, teaming arrangements, and funding. Primary focus markets include the development community and municipal governments that are under regulatory requirements with an estimated average value of $40 million per year for the next 30 years (dependent upon geographic location, state and federal regulatory activity, and new development).

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Rheonix, Inc.

Environmental Problem

Drinking water in the United States is among the safest in the world. Despite that, undetected microbial contamination can lead to serious illness and death. One such pathogen, *Cryptosporidium parvum*, can cause debilitating diarrhea leading to serious illness. A number of outbreaks of cryptosporidiosis have been reported in the United States, including a major outbreak in Milwaukee in 1993 that killed more than 100 people. To monitor drinking water for the presence of *C. parvum* oocysts, water utilities often rely on collecting water samples that then are submitted to an outside reference laboratory for testing. Besides the expense of $350–$650 per analysis, public health is jeopardized by a delay of up to 10 days in obtaining the final results.

Another problem inherent in current testing methods is that determination of the viability status of the oocysts requires additional complicated tests. As effective methods to inactivate *C. parvum* are implemented on a widespread basis in water utilities, it will be even more important to determine the viability of microbes that manage to enter the plant's distribution system, whether in an active or inactive state.

SBIR Technology Solution

With support from EPA's SBIR Program, Rheonix has developed a fully automated and rapid molecular diagnostic system that is able to detect single oocysts of *C. parvum* in drinking water and distinguish viable from nonviable oocysts. Moreover, its patented Chemistry And Reagent Device (CARD™) is able to automatically perform all sample preparation, analysis, and readout without user intervention. A bench-top assay was originally developed by Innovative Biotechnologies International, Inc. (IBI), prior to its acquisition by Rheonix in 2008, that could be completed within 4-6 hours. Considerable direct intervention, however, was required. Those steps included: (1) immunomagnetic separation and washing of oocysts; (2) heat-shock induction of the *hsp*70 mRNA response to differentiate viable from nonviable oocysts; (3) lysis and purification of oocysts; (4) extraction and purification of mRNA; (5) nucleic acid sequence-based amplification (NASBA) gene amplification of the target gene sequences; and (6) detection of the NASBA amplicons on a lateral flow system utilizing liposomes, conjugated to molecular probes, that also encapsulate signal-generating molecules to provide an inexpensive method to detect the amplicons.

The bench-top assay was adapted to Rheonix's fully integrated CARD™ platform, which analyzes clinical specimens automatically. Once a "raw" water sample is applied to the *Crypto*Detect CARD™, required steps are performed seamlessly and automatically. The ease-of-performance reduces the currently high costs associated with monitoring drinking water for the presence of *C. parvum* and significantly reduces the level of training required, providing time and cost benefits in water treatment plants' testing of drinking water for microbial safety.

Commercialization Information

As a result of EPA's SBIR funding, Rheonix currently is preparing *Crypto*Detect CARD™ devices and the software-interfaced control system for evaluation by Battelle Memorial Institute as part of EPA's Environmental Technology Verification (ETV) testing program. Simultaneously, Rheonix is pursuing strategic relationships with companies that actively sell to and service the drinking water industry. The ideal partner for Rheonix is a company that not only maintains a dominant presence in the marketplace but also has complementary products whose sales can be leveraged by the availability of the unique *Crypto*Detect CARD™. The Company will continue to collaborate with EPA to achieve the necessary regulatory approvals to permit the *Crypto*Detect CARD™ to be implemented on a nationwide basis, thereby further improving the safety of the U.S. drinking water supply.

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